GAS JOURNAL

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STEAM AND POWER IN THE GASWORKS

IT was an excellent idea to arrange for the further discussion in this country of Mr. L. J. Clark's paper on this subject presented to the International Gas Union at Brussels last year. The discussion there produced only two speakers. They were two good speakers, and they succeeded in eliciting from the author of the paper some very useful information. Mr. G. E. Currier compared the estimates of steam production and power consumption at his great Tingley works with Mr. Clark's account of practice in the North Thames area, showing very close agreement; an important agreement since it is not often that a completely new works of this magnitude is designed and built in these days, presenting 'an excellent opportunity to incorporate all the most modern features of a fully integrated steam and power system.' A point of detail to note with regard to the raising of steam from waste heat and low grade fuel is that in North Thames practice, though arrangements are made to 'augment' waste heat steam by consuming producer gas and passing it direct to the boilers, it is preferred to make up the deficit of steam from direct fired boilers burning low grade breeze.

This and other points of detail were discussed further at the recent joint meeting of the North of England Section of the Institution of Gas Engineers and the Northern Juniors. Much attention was paid in that discussion to boiler construction, firing, and operation. Some facts seemed to emerge. For breeze-firing of shell boilers there appears to be no reason to doubt that the chain-grate stoker of the Oldbury type is perfectly satisfactory. For boilers and superheaters applied to waste heat recovery, of the usual cylindrical, fire-tube type, a pressure of 300 lb. per sq. in. and a steam temperature of 600°F. seem to be limiting conditions at any rate for the standard methods of riveted construction. Up to these limits there should be no insuperable difficulty.

At Brussels Mr. T. Nicklin initiated an important discussion of waste heat boiler details. He suggested that economisers should be added behind the waste heat boiler to reduce the waste gases to still lower temperatures. Mr. Clark objected that with the very large volumes of gas to be dealt with there might be lack of uniformity of distribution over the surfaces giving rise to over-cooling in certain regions with consequent corrosive condensation. There was also a very illuminating interchange of views with regard to the effective use of still higher superheat. Mr. Nicklin suggested that high superheat would be more beneficial than high pressure but Mr. Clark thought the facts were against this view—the selection of pressure and temperature for any particular application should be properly matched to the conditions. With the steam turbine, steam at not more than 0.95 dryness fraction at the exhaust was preferred by the makers. It appears therefore that coke breeze is better applied to boiler firing than to a supplementary superheater.

Mr. Nicklin also elicited some useful information from Mr. Clark about the cost of generating electricity with the waste heat turbine. Mr. Clark had estimated that the overall capital cost of a combined gas turbine and steam system might be in the region of £80 to £100 per kW of installed capacity, but even increasing this to £100 to £150 he did not think the cost per kilowatt generated at 85% load factor would exceed 0.4d.

This figure and the general increase in steam and power available in the modern large gasworks brings one back to Dr. J. Burns' paper (Comm. No. 385) of June, 1951. Two things are clear. One that there will be a considerable overall excess of power over the requirements of even a completely electrified plant and the other that this excess will be greatest at night when it is of least value to the electricity supply authorities. It will be remembered that Dr. Burns made the interesting and valuable suggestion that this excess power might be used internally. It could be used for the electrolysis of water, where 1 kWh would produce 3.7 cu. ft. of oxygen and 7.5 cu. ft. of hydrogen. The use of the oxygen to enrich the air supply to producers is obvious, but that of the hydrogen is not so clear, at any rate in processes standard today. But Dr. Burns' alternative,

that of the use of the surplus electrical energy to produce oxygen in the liquefaction process is, one would think, worthy of immediate consideration, since in this way 50 cu. ft. of oxygen would be produced by the use of 1 kWh. There would seem to be several uses for oxygen, apart from the producer where it would solve many problems. It has been suggested that it is nearly worthwhile to purchase oxygen for revivification of oxide *in situ*. And Dr. Burns foresees the day when, with the gas turbine 'working in association with our well-tried carbonising processes,' we may get on with the development of hydrogenation and for complete gasification plants such as those in hand in the West Midlands.

BOOSTING DOMESTIC COAL USAGE

IN its memorandum to the Ridley Committee the Gas Council referred to the practical tests of the efficiency of fuel utilisation in the provision of heat services in houses which has been undertaken with great thoroughness by the Building Research Station at Abbots Langley. From the experience gained of actual fuel usage with a variety of appliances and a variety of combinations of fuels it has been shown that the net coal requirement can vary from about 3½ tons to 7 tons per annum. The results show that the lowest coal requirements were experienced in those houses where gas and coke were the fuels used. The available evidence on domestic fuel requirements shows that an adequate service can be given in a well-constructed house of about 1,000 sq. ft. floor area by the use of 35-40 cwt. of coke per annum and 250-270 therms of gas. If this were the typical pattern of domestic fuel usage in Great Britain it would represent a saving of 14-15 mill. tons of coal per annum over present consumption. This is the objective of the gas industry policy in domestic fuel supply.

We recall the foregoing in view of the forceful drive being made by the Coal Utilisation Council to extend the use of bituminous coal in the home; and it may be recalled, too, that the many recommendations of the Ridley Committee included more Government loans to industry for the installation of fuel saving equipment on more attractive terms and the production of a 'utility' grate for domestic use, with financial incentives to users. The Coal Utilisation Council, which is representative of the producers and distributors of solid fuel appliances, is a very live and quite an influential body and its activities naturally affect the gas industry. Early last year the Council commissioned a survey (which was undertaken by the Research Department of Mather and Crowther) to 'present a picture of how solid fuel is used in the homes of this country, of the appliances in which it is used, and of the public's preference and needs for heating, cooking, and hot water supply.' The picture was in fact presented in most attractive booklet form last week and the findings of the survey were circulated to Ministries, local authorities, architects and other interested bodies, and to the Press. We have never been able to assess in our mind the validity of surveys of the type, however carefully and conscientiously they may be undertaken, but there is no doubt that this latest report of the C.U.C. (the price is 6s.) is good propaganda—and, as we have said, the findings are set out in a most interesting way.

The subject-matter of the investigation of 2,000 households, selected to be 'an accurate cross-section of the population,' was decided jointly by the C.U.C., the National Coal Board, the Coal Merchants Federation of Great Britain, and the Co-operative Union, Ltd. We are not going to detail the conclusions, but we may glance at a few of them. The survey 'revealed' that 44% of the households would like, on an average, an additional 14 cwt. of coal—a total for the nation of 4½ mill. tons—and the Council sums up the situation by saying that only one household in four does not really need more coal than it gets today. The survey indicated that solid fuel is used by 98% of families to heat their main living room. Commenting on the fact that 25% of households have no water heater, the Council is of opinion that the housing conditions revealed by the survey cannot be remedied without financial incentives to landlords and owners, encouragement to local authorities, and credit facilities for the general public. And with an unrestricted supply of fuel of all types at today's prices 92% of housewives, according to the survey, would prefer solid fuel for space heating, 45% for water heating, and 14% for cooking.

The implication throughout the survey, the C.U.C. states, is that the real task for which increased publicity and credit facilities are required is to secure the installation of (1) efficient double-duty appliances giving piped hot water (from either cooking or space heating) in the kitchen living rooms of the poor class older houses, and (2) efficient convector fires or openable stoves in the living rooms of bigger houses, possibly combined with a back boiler for hot water supply or for background heating. The C.U.C. is obviously out to push double and triple purpose appliances bearing no purchase tax, enjoying 'financial incentives' and other forms of encouragement, and designed to burn bituminous coal—and '28% of housewives believe they would save on gas or electricity if more solid fuel were available.' The while, of course, gas is battling with heavy purchase tax on all appliances except cookers, to say nothing about the strangling effect of the Hire Purchase and Credit Sale Agreements (Control) Order, 1952.

MECHANISED SPENDING

GOVERNMENT DEPARTMENTS will have to look to their laurels, for we learn that a machine has now been produced capable of consuming £250,000 a day. Even in this machine age, one feels that this is carrying mechanisation too far. Into its rapacious maw approximately 80,000 treasury notes can be charged at a time, and the last word in refinements has been incorporated to ensure that it does its job properly—for example, a rocking bar hearth, motor-driven through worm reduction gears, to separate the bundles of notes and break up the resulting ash. Those who wish to inspect the progress of burning (which must be a heart-rending occupation) look through an armour-plated glass-covered spy-hole projecting from the front of the machine, while the whole apparatus bristles with as many safety devices as a modern strongroom. Even the

ash drawer has a special lock lest any enterprising person should seek to piece the ash together again. The gas industry will be chagrined to know that this machine is operated by electricity, though we may, perhaps, gain some consolation from the fact that while gas is used at the Royal Mint to make money, no gas appliance has yet been devised which can consume money at such a rate.

MODERN LIVING IS EXPENSIVE

THE NORTH THAMES GAS BOARD'S magazine *Modern Living* was virtually put on trial on February 26 at a meeting of the North Thames Gas Consultative Council when Mr. Leslie Hardern, Public Relations Officer to the Board, gave a brief outline of its history and development. Before the war the North Thames Gas Board started two magazines, one called *Hearth and Home* for the lower income groups, the other *Modern Living* which was produced for the housewife with more leisure, both these magazines being distributed free to all consumers in Greater London. During the war both magazines were dropped, and afterwards, when all income groups had virtually merged into one, publication was resumed as one journal for all consumers and now sells at 3d., running at a loss of £3,000 a year which is subsidised by the North Thames Gas Board. A great deal of controversy arose, following Mr. Hardern's talk, as to whether *Modern Living* should be allowed to continue in its present form—*i.e.*, with practically no relevance to the gas industry and with little propaganda value, and yet be subsidised by the Board. One member said it should cease altogether and another thought it should be given free of charge to all consumers. But the general feeling was that the magazine should continue in its present form, though giving more reference to the use of appliances from the housewife's point of view, because, the argument went, there are hundreds of 'beauty hints' and 'sentimental stories' on the market, but very few journals with the information that the consumer really wants to know about the appliances she uses—*i.e.*, new simple recipes to be used in gas cookery, and articles on up-to-date appliances from the consumer's angle, and not as presented by the manufacturer.

TAX CUTS SOUGHT

SUBSTANTIAL TAX REDUCTIONS are sought by the Federation of British Industries in a series of representations which it has made to the Chancellor of the Exchequer in reference to the 1953 Budget. Emphasis is laid on the need for an examination of the wider aspects of purchase tax which, as the Gas Council and the area boards have persistently pointed out in recent years, has had a serious adverse effect on the sale of new gas appliances which might well have effected savings in gas consumption. It is pointed out that with the emergence of a buyers' market the operation of purchase tax in its present form is having severe repercussions on the whole of British industry, repercussions which could not have been foreseen when the tax was introduced. Many suggestions have been or are being advanced by individual industries for the reduction or complete removal of the tax on their products. The whole question of the structure, present purpose, and incidence and implications of purchase tax has become of such significance to industry that the Federation considers there should be an enquiry by a fully representative body.

Tax changes urged by the Federation include reduction in the standard rate of income tax to provide incentive for enterprise and the means of saving; extension of the earned income allowance to the higher ranges of income; abolition of excess profits levy and profits tax; change in the method of calculating depreciation on fixed assets and of valuing stocks; and relief on the valuation for death duties of family businesses. In January the Federation issued jointly with the National Union of Manufacturers a public statement on the general economic position, emphasising that a permanent increase in overall production and in exports would not be achieved until taxation had been materially reduced. The Federation has now, in accordance with its usual practice, made its own representations to the Chancellor. They fall into two parts, the first dealing with fiscal policy and the second with specific points of tax law.

'ALL THE YEAR ROUND'

FOLLOWING A PRE-VIEW on Monday by the Queen, the Duke of Edinburgh, and Princess Margaret, the *Daily Mail* Ideal Home Exhibition at Olympia was opened to the public yesterday and from now until March 28 one of the first great spectacles of Coronation Year will be visited daily by thousands of people from far and near. We hope to publish next week some of our impressions of this brilliant and popular domestic shop window, to which the gas industry makes a worthy contribution. Gas and coke appliances for the home have been so permanent a feature of the exhibition that it is hard to realise that it was only last year that there was for the first time a composite gas section, the Gas Pavilion being designedly surrounded by the stands of the firms which manufacture such appliances. At an eve-of-Olympia Press pre-view at the Gas Council's headquarters on Friday—attended not only by the Press but by leading representatives of the manufacturers and officials and members of the area boards—Colonel Sir Harold Smith explained that the gas industry's theme this year is 'All the Year Round with Mr. Therm.' It has concentrated on what it has to sell to the housewife by showing examples of modern appliances which will give good service and good value for money for every season of the year and every type of job. The Pavilion has been set out in sections devoted to various types of appliances—water heaters, cookers, space heaters, laundry equipment, and coke-fired appliances, which can be examined at first hand.

Sir Harold paid tribute to the appliance manufacturers without whose whole-hearted support a complete Gas Section would have been impracticable and proceeded to describe some of the new appliances which are always a feature of the section—including a portable gas attachment which enables a back boiler to be used in the off season; unusual and interesting features in new cookers; and a handsome new gas fire shortly going into production which will give both radiant and convected heat. He referred again to those 2 mill. obsolete cookers which were awaiting replacement at the time of the issue of the Gas Council's first annual report. Over the past three years about 1 mill. have been replaced by appliances which require an average of only three therms to do the jobs which needed five therms in the old appliances.

DEARER GAS

AN IMMEDIATE INCREASE of 1d. a therm in the price of gas because of the 10% rise in the price of coal was announced by the North Western Gas Board on Monday. The North Western Electricity Board decided not to increase tariffs. Mr. D. P. Welman, Chairman of the Gas Board, said the coal price rise would mean 6s. 2d. a ton more on the gas industry's costs. The electricity industry using lower grade coal, would have to pay only 3s. 7d. to 5s. 7d. a ton extra.

Personal

Mr. L. W. Webb, Managing Director of the General Descaling Co., Ltd., left this country on February 14 to visit Baghdad, Bazra, Kuwait, Pakistan, India, Ceylon, Singapore, Australia, and South Africa, and will return via Jordan, Istanbul, and Italy.

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Miss Mary Francis Flack, Editor of *Commentary*, and Press and Publications Officer of the Women's Gas Federation, is giving up her post with the Federation after five-and-a-half years, in order to be able to concentrate on her work as a playwright. **Miss Barbara Sim,** her successor as Editor of the journal, is a regular contributor to the *Nursing Mirror*. Miss Sim writes on a variety of subjects and, in particular, on children, for *Britannia & Eve*. **Miss Jessie Frith,** O.B.E., General Secretary, will be carrying out the public relations side of the work of the Federation.

Miss Mary Flack

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Mr. L. J. Keslake has been appointed General Manager of the Dorset group, Southern Gas Board, which has been formed as the result of the amalgamation of the former Weymouth and Dorchester, Bridport and Lyme Regis, and Sherborne and District groups. Mr. A. C. Treavis has been appointed Group Accountant. The Southern Gas Board's Western division now comprises two groups—Bournemouth and Dorset.

1953 'Journal' Directory

THE following changes have been notified during the past month. To keep the information in the 1953 edition of the *Gas Journal Calendar and Directory* up to date readers are invited to note these alterations (together with the appropriate adjustments relating thereto in the 'personnel' section of the *Directory*, pp. 141-156):

Page 80 and 83.—WEST SURREY DIVISION: A. H. Savill, formerly *Div. Asst. E.*, now *Deputy Div. E.*

,, 82.—METROPOLITAN DIVISION: B. C. Hinwood, *Deputy Div. E.* (while continuing as *Station E.*, East Greenwich).

,, 86.—TUNBRIDGE WELLS: C. A. E. Read, *Station E.*, vice G. J. B. Cox, removed.

,, 92.—CREWKERNE: Transferred from South Western to Southern Gas Board.

,, 97.—SOUTHERN GAS BOARD: W. F. Thorne, formerly *Production E.*, Western division, now *Technical Officer*, headquarters.

,, 102 and 103.—WEYMOUTH, SHERBORNE, AND BRIDPORT GROUPS: These groups have been amalgamated into one group, to be called the DORSET GROUP, with headquarters at 70 and 72, St. Thomas Street, Weymouth. L. J. Keslake, *GM*; A. C. Treavis, *Group Accountant*. Western division, Southern Gas Board now comprises two groups —Bournemouth and Dorset.

,, 115.—WEST MIDLANDS GAS BOARD: A. V. Horsfall, formerly *Deputy Sales and Service Manager*, now *Sales and Service Manager*, vice J. T. Rees.

,, 127.—CRIEFF.—Delete J. Napier, *Dist. M.*, retired.

,, 166.—MONTEVIDEO GAS AND DRY DOCK.—W. A. H. Keeley, formerly *MD*, now *GM* (Uruguay).

,, 173.—VICTORIA, B.C.: Sales 459 mill. cu.ft.; C.V. 499; consumers 9,214.

,, A11 and A85.—WILLIAM PRESS & SON, LTD. (Tottenham address): T/N TOTtenham 8171-8176.

Obituary

Mr. Harry J. Smith, formerly Distribution Superintendent with the old Shotley Bridge Gas Company, Co. Durham, has died at Blackhill. He was 85 years old and retired eight years ago after 49 years with the company.

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Mr. H. B. Fergusson, Senior Director of G. A. Harvey & Co. (London), Ltd., died suddenly on February 20. Educated as a mining engineer at the Royal School of Mines, Freiberg, Germany, he was later articled to his father, and became a full Member of the Canadian Society of Civil Engineers in 1915. He joined G. A. Harvey & Co. in July, 1933, as manager of the heavy construction department, and was largely responsible for the growth and development of the company's activities in the oil, chemical, and heavy engineering industries. He was appointed to the Board in May, 1938.

Diary

March 7.—Scottish (Eastern) Juniors: Joint meeting at Glasgow. Paper by W. K. Tate, Junior Vice-President, Institution of Gas Engineers.

March 11-12.—Gas Sales and Service Conference, Seymour Hall. (For full programme see *Journal*, January 14, p. 91.)

March 11.—British Wood Preserving Association: Annual General Meeting, Holborn Restaurant, 11 a.m.

March 13.—London Juniors: 'Southampton's Gas Distribution System,' R. K. Harrison. 178/180, Edgware Road, W.2, 6.30 p.m.

March 16.—Eastern G.C.C.: Connaught Rooms, Kingsway, W.C.2, 2 p.m.

March 17.—London and Southern Section, I.G.E.: 'Firing of Pottery Kilns by Gas,' A. F. Searle.

March 17.—Midland Juniors: '25 Years' Experience on a Chemical Works,' H. Alridge, Birmingham. Staff Mess Room, West Midland Gas Board, Council House, Birmingham.

March 18.—Eastern Juniors: Stamford; Visit to the Works of Williamson Cliff Refractory Co., Ltd.

March 18.—South Western Section, I.G.E.: Cheltenham. 'Integration and the Scope for Development,' T. W. Jackson; 'Some Aspects of Works Management,' T. N. Dent.

March 18.—Manchester Juniors: Visit to Davyhulme (Manchester) Sewage Works, by invitation of Manchester Corporation Rivers Department. 'Treatment of Industrial Effluent.'

March 19.—London Juniors: All day visit to Chesterfield Works of the Staveley Iron and Chemical Co., Ltd.

March 19.—Wales Juniors (North): Visit to works of C. R. Averill, Ltd., Caergwrle; talk on 'Painting Problems' by a member of the technical staff of C. R. Averill, Ltd.

March 21.—Midland Juniors: Annual Dinner; Imperial Hotel, Birmingham.

March 26.—Midland Juniors: President's Day, Birmingham.

March 26.—North Thames G.C.C.: Westminster City Hall, Charing Cross Road, W.C.2.

March 26.—Northern and Manchester and District Sections, I.G.E.: Joint Meeting and Visit to new Howdon gasworks.

March 27.—Scottish (Western) Juniors: Royal Technical College, Glasgow. Short Paper Night.

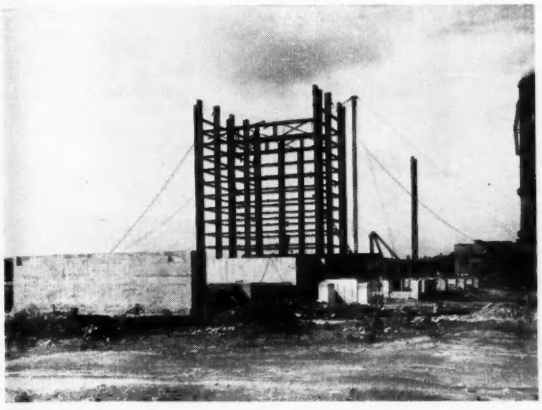
March 28.—Western and Wales and Monmouthshire Juniors: Joint visit to Bedwas Coke Ovens, Newport, Mon. Discussion on Coke Oven Gas Supply compared with normal Gasworks Methods of Carbonisation.

April 1.—Eastern Juniors: 'Small Works Practice,' H. W. M. Fiske and E. S. Williams (Members); Peterborough.

April 7.—South Eastern G.C.C.: Katherine Street, Croydon, 2.15 p.m.

TOMORROW (THURSDAY) in the B.B.C. Home Service programme 'Taking Stock' feature at 9.15 p.m., there will be a discussion on the position of the consumer of supplies from nationalised industries. The speakers will be Mary Stewart, author of a recent booklet on consumers councils, J. T. Beresford, a farmer and a member of an electricity consultative council, J. C. Rodgers, M.P. for Sevenoaks, and Alderman J. W. Moore, C.B.E., Chairman of the Southern Gas Consultative Council.

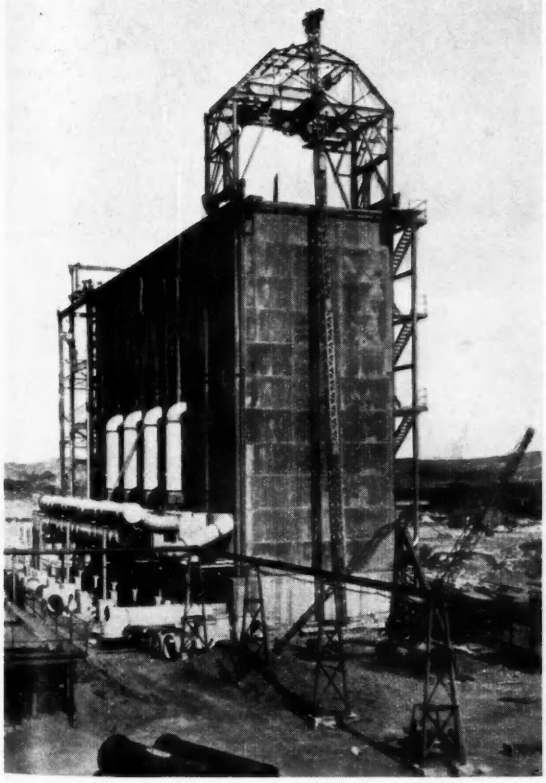
Balfour-Lecocq Tower Box Purifier



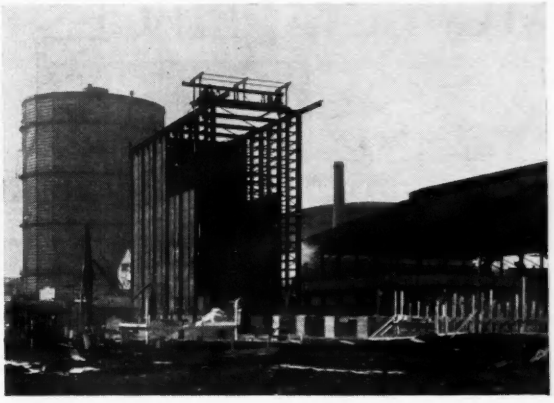
The foundations were completed and erection of the steel framework was started in the summer of 1951.

PROGRESS on the Balfour-Lecocq tower box purifier, known as the tower box by reason of its compactness, has reached a further stage of development. The first installation at Rotherham, of plant capable of purifying 10 mill. cu.ft. of gas per diem, is nearing completion.

The towers have successfully passed pressure tests and, although the full quantity of trays is not yet available, the East Midlands Gas Board expects to start up the installation on half gas throughput in a few weeks.



A later view shows the completed plating, a late stage in the erection of the gas connections and of the overhead crane.



The above photograph shows the position when the plating was approximately half completed.

The details of the tower box were outlined in an article by A. C. Bureau and L. R. Meek when the design was first publicised in 1949. Briefly, the advantages arise from the detail of construction and the arrangement, which enables a great degree of mechanisation to be introduced, together with the maximum saving of ground space. In addition, the possibility of an unsatisfactory joint between any of the trays has been eliminated by the use of a simple water seal between each tray, maintained by a constant feed of water.

From the first, great interest was shown in the new design. The East Midlands Gas Board placed an order for a tower box installation, at their Meadow Hall works in Sheffield, which had a capacity of 5 mill. cu.ft. per diem, but which could be extended to handle 12 mill. cu.ft. per diem. Orders were later placed by the North Thames Gas Board for tower boxes at Southall and Bow Common.

However, changes in policy determined the East Midlands Gas Board to abandon the project for the Meadow Hall works and to plan the expansion of output of the Rotherham gasworks. Consequently the original order for the first tower box installation was altered to one for a 10 mill. cu.ft. per diem plant, with extension planned to double that capacity.

Although the first installation is not yet in operation, the order has also been placed for the extension to a capacity of 20 mill. cu.ft. per diem and the foundations are now completed.

The change of plans necessarily delayed the contract, a delay aggravated by operation of steel allocation, but foundations were completed and the steel framework begun in the summer of 1951.

After the erection, plumbing was carried out, and plating and site welding was commenced. The method adopted was very successful, and no trouble due to deformation was experienced.

The plant is being built by Henry Balfour and Co., Ltd., of Leven, who are jointly responsible with Les Fours Lecocq, S.A., of Brussels, for the design and conception of tower box purifiers. The special water sealing arrangement between the trays in each tower is subject to a patent by Les Fours Lecocq, S.A., and the detailed design of the main plant is by Henry Balfour and Co.

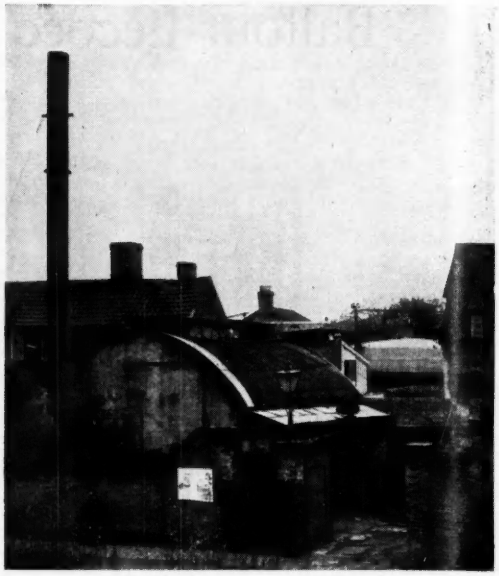
The oxide handling plant, apart from the tippler and the oxide hopper, is being fabricated by Owl Engineering Supplies, Ltd., of Doncaster, to the requirements of the East Midlands Gas Board. In principle, it is similar to that in use at the Neepsend (Sheffield) works of the East Midlands Gas Board, including breaking and disintegration of the discharged spent oxide. The foundations are by the F. C. Construction Co., Ltd., of Derby.

The tippler and the overhead travelling crane, capable of lifting 40 tons, are fabricated by Strachan and Henshaw, Ltd., of Bristol, and the passenger lift is by the Keighley Lift Co., of Keighley.

All the materials of construction in the installations are of British origin, and the greater part is fabricated in Scotland.

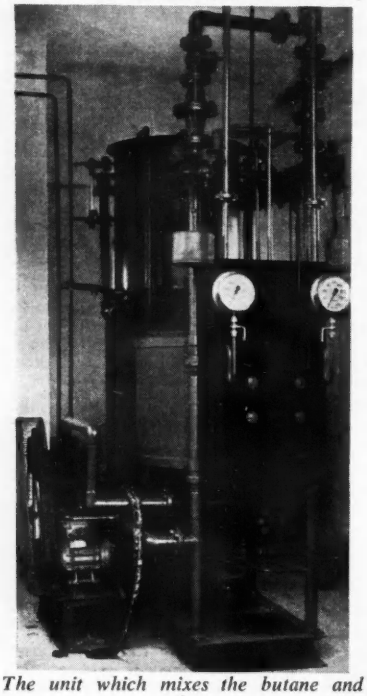
GASWORKS BECOME MUSEUM PIECES

Butane/Air Supersedes Coal Gas at Framlingham and Bungay



The coal retort house at Framlingham now closed down.

FOLLOWING within 12 months of Britain's first full scale experiment (at Whitland, Carmarthenshire) in substituting a butane/air mixture for coal gas, distributed through existing mains, for the entire town gas requirements of a small community, the small undertakings at Framlingham in Suffolk and at Bungay in Norfolk, both in the area of the Eastern Gas Board, discontinued manufacturing coal gas and instituted a butane/air supply on New Year's Day. The change over in both cases appears to have been effected successfully.



The unit which mixes the butane and air

Coal gas was first made at Framlingham works in 1850 and, when taken over by the Eastern Gas Board in 1949, the plant was in bad shape. In spite of improvements which the Board made, it was obvious that the operation of the works could only be uneconomic. Framlingham is too isolated for a case to be made for carrying a bulk supply main from a neighbouring point of manufacture, more particularly so because the nearest works is, itself, comparatively small, so that the cost of manufacture there is fairly high.

It was decided, therefore, that the installation of a butane/air plant might well provide the proper solution to the problem at Framlingham and, following visits by officials of the Board to France and, subsequently, to Whitland, the Holmes-Mallet plant was selected.

The purchase of this plant was authorised by the Eastern Gas Board in December, 1951, and instructions were given to W. C. Holmes & Co., Ltd., forthwith. The building to house the plant and its compound for the storage tanks were designed by the Board's staff to conform to the contractors' requirements, and were executed by a local contractor. Work on the site commenced at the end of August, 1952, and the supply was changed over from coal gas to butane/air on January 1, 1953.

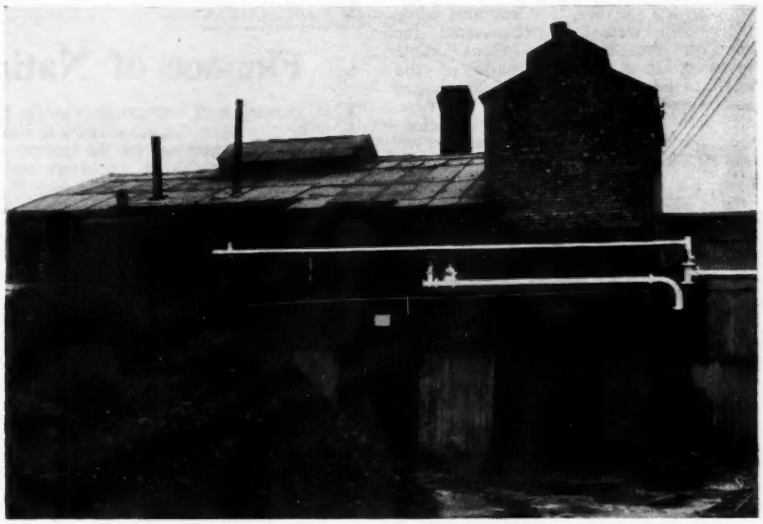
There had been no previous declared calorific value at Framlingham and, therefore, it was considered necessary to make a first declaration as from that date. The calorific value selected was 720 B.Th.U. per cu.ft.

The Framlingham plant is provided with six storage containers, designed in accordance with A.O.T.C. Standards for working pressures of 100 p.s.i., having been tested to 200 p.s.i. Each container will hold about a ton of butane and, in this small district, this represents some five days' supply. The containers differ from those put in at the Whitland plant in that they are designed to operate in the horizontal position throughout, thus eliminating the awkward manœuvre of unloading from the horizontal position on the transport and setting up in the vertical position for working. This is a matter of some importance where containers may be handled by only one man, using a travelling chain block.

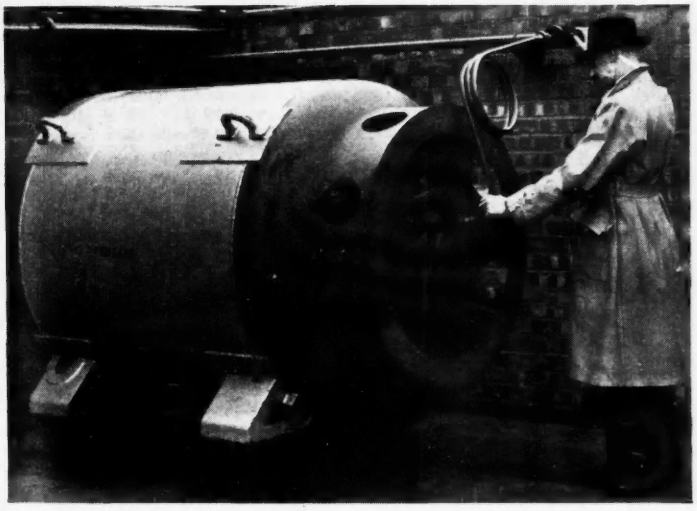
The first butane container installed at Bungay during the construction of the loading bay. There are now ten of these containers at Bungay.

The containers are transported between the oil refinery and the gas-works on lorries, from which they are unloaded by means of a chain block on a runway and lowered on to small bogies, on which they are run into their working positions. They are connected each with two 'exactor' couplings, which automatically seal themselves against pressures up to 1,200 p.s.i., when they are disconnected. One connection is for butane vapour and the other allows the liquid itself to be drawn off. Small test holes with sealing caps are provided to indicate the level of liquid in the containers.

As the boiling point of butane is 31°F., it will be seen that the vapour required may be obtained in either of two ways; firstly, by connecting with the vapour space above the liquid in the containers, when gas is drawn off directly, the latent heat of vaporisation being taken from the bulk of the liquid and through the steel walls of the containers. In very cold weather, or when the container is nearly empty, the heat transfer may be inadequate and the consequent cooling of the liquid butane



The old retort house at Bungay which passed out of commission on New Year's Day.



Mr. J. H. Greenacre, Yarmouth Group Manager, examines one of the butane-air containers in the new loading bay.

may reduce its vapour pressure too much.

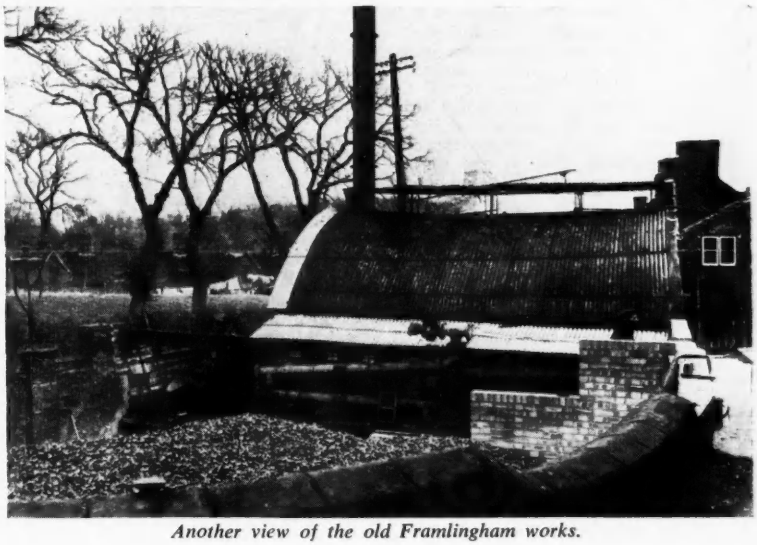
Alternatively, the liquid butane can be drawn off and vaporised in a vessel housed in the main building. This vaporiser is simply a pressure vessel containing a spiral of steel tubing, through which warm water is circulated by means of a small electric pump. Heat is supplied to the water in a water heater fired by neat butane. The level of the liquid butane in the vaporiser is controlled by a balled float valve and the resulting vapour is drawn off from the top of the vessel and passes to the mixing plant.

The design of the mixing plant is probably well known now, but, briefly, air and butane blowers are driven by a 1½ h.p. electric motor, the drive being so arranged that, in the event of any failure, both blowers must be stopped together. The apparatus includes a water sealed governor, controlling the flow of butane vapour to the blower, and there is a composite washing tower in which the butane is bubbled through benzole and scrubbed with gas oil.

From the blowers, the gas and air pass to the mixing chamber and so to the gasholder. The plant is provided with a number of safety devices such as non-return valves and pressure operated switches which will shut the plant down if abnormal conditions develop. There is also an arrangement by which a Sigma calorimeter, recording the C.V. of the mixed gas, will operate a switch breaking the control circuit, if the C.V. varies beyond pre-determined limits.

The control panel, housed in a separate cubicle in the building is provided with an ingenious system of indicating lights, by means of which the operator can see what fault has, in fact, caused the plant to shut down.

There are about 290 consumers at Framlingham and additional fitters moved in on December 8, 1952, to assist in the preparatory conversion of appliances. In a large number of cases,



Another view of the old Framlingham works.

cookers were loaned to consumers while their own were being converted for use on the new gas. Considerable investigation had been made of the work to be done on various appliances and supplies of replacement burners, etc., had been ordered. Shortly before the end of the year, a test supply of butane/air was laid on at the works to assist those engaged in the adjustments. Conversion sets of burners and jets were available for many of the appliances but, in some cases, it was necessary for the Board's staff to do the work themselves and, generally speaking, everything was converted satisfactorily, including water heaters, a hair dryer, and bunsen burners in the laboratories of the school.

The gas was changed over at 9 a.m. on January 1 and a large team of gas fitters from Ipswich went through the town adjusting the simpler pieces of apparatus and converting such items as instantaneous water heaters, which required a complete change of jets, etc. Gas fires and incandescent lights were found to be capable of quite a simple adjustment after the change over, in order to restore their performance to normal.

All meters over five years old were replaced before January 1 and some of the new ones put in were fitted with specially dressed diaphragms. A record is being kept of these meters and, in two or three years' time, a number will be brought in for examination and comparison with meters having the normal diaphragm.

Generally, the change over was carried out without serious inconvenience to any of the consumers and, indeed, with no inconvenience at all to many of them. It is felt that the consistent quality of the new gas, together with the fact that it is free from sulphur, commends it to the consumers, and that satisfaction has been given throughout, by this change.

The position at Bungay, where the change over was effected on the same date, was approximately similar, and the new plant is also like that installed at Framlingham. Latest statistics give the number of consumers at Bungay as 331 domestic and 57 non-domestic.

We are indebted to the Editor of *T.D. News* for the loan of blocks and photographs to illustrate this account of the double change over. It was admittedly unusual for *T.D. News* to go off the Tottenham division for the novel story of how the little old gasworks at Framlingham and Bungay became museum pieces. It appears that at one time it was thought likely that Thaxted works on the northern fringe of the Tottenham division would also change to butane/air, but whereas Framlingham and Bungay works were in a bad state of disrepair, Thaxted, though producing coal gas at a comparatively high price, is still in good working order.

Among the 250 guests who attended the annual staff dance of Sunderland Division of the Northern Gas Board on February 19 were Mr. E. Crowther, Chairman of the Board; Mr. W. O. Kirkwood, Divisional General Manager; and Mr. L. A. Garratt, Industrial Relations Officer. Prizes were presented by Mrs. Kirkwood, who was presented with a bouquet by Miss M. Miller.

IN PARLIAMENT

Finance of Nationalised Industries

THE question of how the nationalised industries raise finance crept into the discussion in Committee on the interpretation of Clause 20 of the Iron and Steel Bill on February 24.

Mr. ROY JENKINS (Stechford) claimed that so far as the sum of up to £250 mill. which might be raised by selling off parts of the industry and the other sum of £150 mill., less certain specific liabilities which had to be met, part of the privately-owned iron and steel industry would, after denationalisation, be able to get public money far more easily—with less need for the sanction of the House—than the wholly nationalised industries. Was it not a very extraordinary state of affairs that they were passing back the profit from this industry into private hands, and yet they were making it easier for it to get public money than would be the case with gas, electricity or other publicly - owned undertakings.

Mr. GERALD NABARRO (Kidderminster) urged the hon. Member to tell the Committee how the Electricity Authority, or the Gas Council for that matter, came within the control of the House with regard to new issues of capital. Was it not a fact that recently the Electricity Authority wanted £150 mill. and that it did not come anywhere near the House for it? It went through the usual process of applying to the Capital Issues Committee.

Mr. JENKINS maintained that it went to the market, and why, therefore, could not the privately-owned steel industry go to the market and get money there?

Mr. NABARRO accused the hon. Member of confusing two issues. What he said earlier was that the nationalised industries had to come to that House for sanction to raise capital. [HON MEMBERS: 'He did not.'] That was exactly what he said, insisted Mr. Nabarro. In fact, they did nothing of the kind. All the nationalised industries did was to apply to the C.I.C. for permission to raise the money after which they went to the market for the funds required.

Mr. JENKINS strongly denied that he said anything of the sort. What he did say was that it was possible under this arrangement for the privately-owned iron and steel industry to get public money more easily than the publicly-owned nationalised industries could get it. There was no denying that at all, and it seemed to him a most extraordinary state of affairs.

INSTITUTION OF GAS ENGINEERS

Eastern Section

A GENERAL meeting of the Eastern Section of the Institution of Gas Engineers was held at 17, Grosvenor Crescent, London, on February 19 under the Chairmanship of Mr. Bernard Clarke, Lincoln, Senior Vice-Chairman, deputising for Mr. F. A. Rhead who was absent through illness. An apology for absence was received from Mr. George E. Currier, President of the Institution of Gas Engineers, who was out of the country.

The Chairman regretted he would not have the pleasure of presenting a certificate in Higher Grade Gas Engineering (Manufacture) to Mr. F. Courtney, Grimsby, who was serving in H.M. Forces, because, he remarked 'there are too few people these days who are the recipients of these certificates, and it is a pleasure and a privilege when we are able to welcome them.'

Mr. J. W. Wilson, Divisional Mains Engineer, East Midlands Gas Board, Lincolnshire Division, and Mr. E. Aspinall, Director of Robert Dempster and Sons, Ltd., Rose Mount Iron Works, Elland, were elected members.

Two short Papers—'Automatic C.V. Control' by K. R. Mortimer, Engineer and Manager, March District, Eastern Gas Board (Cambridge Division) and 'The Trend of Gas Consumption and its Effect upon the Future' by A. Collinson, Distribution Superintendent, Peterborough District, Eastern Gas Board (Cambridge Division) were presented.

A vote of thanks to the authors was proposed by Mr. R. C. Wardell (Boston) and seconded by Mr. D. B. Parkinson (London).

Midland Section

A SPECIAL MEETING of the Midland Section of the Institution of Gas Engineers was held in Birmingham on February 6 under the Chairmanship of Mr. J. E. Wakeford.

Members stood in silence in memory of the late Mr. George Helps, Nuneaton, who was a Past President of the Midland Association of Gas Engineers and Managers.

Mr. Wakeford presented certificates to the successful students in Higher Grade Examinations, in Gas Engineering (manufacture and supply).

The paper on 'Oxide Purification in Towers' originally presented at the Institution Meeting in June last was reintroduced for discussion by the authors, R. G. Warr and E. T. Pickering, of Birmingham. They were able to give details of the additional work and experience gained with the purifiers since the paper was first written.

A long and interesting discussion took place, contributors to which were Messrs. F. Pyper (Sheffield), S. K. Hawthorn (Birmingham), A. Allen (Coventry), A. W. Elliott (Derby), F. H. Bate (Dudley), L. H. Thomas (Smethwick) and C. Cooper (W. C. Holmes & Co.).

The authors suitably replied to the discussion, and were thanked on behalf of the Section by Mr. W. MacNaughton, Senior Vice-Chairman, and Mr. C. C. Wood, Junior Vice-Chairman.

On February 26 the Section met jointly with the Institution of Sewage Purification to hear a paper on 'Further Experimental Work on Gasworks Liquor Treatment,' by A. J. Clifford and J. T. Rees.

COAL GAS AND ALUMINIUM

IN February, 1948, an aluminium roof was installed over the dry purification plant at Sevenoaks, Kent, gasworks. This was an experiment that the South Eastern Gas Board was making to ascertain the suitability of aluminium as a structural material in gasworks, and the purifier was chosen because the severity of the conditions of exposure was known. So successful has the experiment been that the South Eastern Gas Board has recently erected other aluminium roofs at its works at Wandsworth and Guildford.

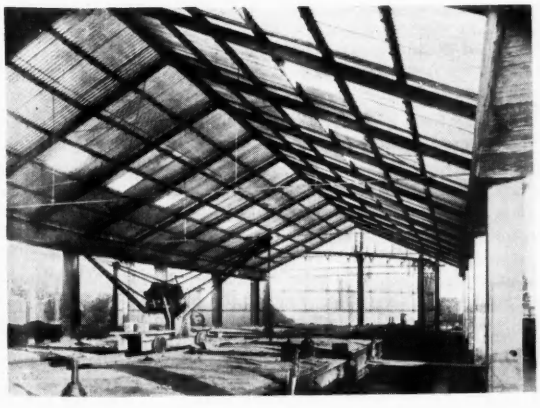
The roof was built by the Aluminium Construction Co., Ltd., using standard structural sections with corrugated sheet covering. The metal was supplied by the Northern Aluminium Co., Ltd., the alloys being Noral 51S for the sections and Noral 3S for the sheet—H10 and N3, respectively, in the British Standards designation system. No paint or other protection was applied.

Now, after nearly five years, the condition of the roof is apparently unimpaired, though it has lost its original brightness. This change in appearance took place during the first year or so. Superficial examination reveals roughening of the surface of the metal and slight pitting, but there is no evidence of appreciable deterioration. To verify the apparent soundness of the roof the South Eastern Gas Board arranged with Northern Aluminium Co., Ltd., to remove a structural member and a sheet and have them subjected to laboratory examination. This has been undertaken by Aluminium Laboratories, Ltd., and entirely confirms that the corrosion is only very slight.

The specimens were taken in January, 1952, after nearly four years' exposure. Metallurgical examination revealed pitting corrosion of the structural member to a maximum depth of 0.0173 in. and a mean depth of 0.0063 in. The thickness of the section being $\frac{1}{4}$ in. on the flanges and $\frac{3}{16}$ in. on the web, this penetration is insufficient to affect the strength appreciably, as was proved by tests which showed that the tensile properties still exceeded the minimum figures required by BS. HE10, on which the design of the structure was based.

On the sheet specimen, which was 0.028 in. thick, there was pitting to a maximum depth of 0.0047 in. on the inner surface; the outer surface showed only very slight superficial corrosion. Tensile tests confirmed the soundness of the sheet, the figures obtained being well above the minimum demanded by B.S. NS3.

On the results of these tests it is quite safe to assume that the roof will have a life of at least 25 years, provided it is undisturbed and free from accidental damage.



Research extending over many years has shown that the main type of attack to which aluminium alloys are subjected on exposure to aggressive atmospheres is by pitting, pits being formed at the points at which the protective oxide film, characteristic of aluminium alloys, is weakest. Though the onset of pitting corrosion may be rapid, as the points of weakness are taken up the rate at which new pits form must diminish. Moreover, under many conditions of exposure a new oxide film is formed, which prevents further attack.

Pits may be deep—'pinholes'—or broad and shallow. The degree of deterioration is indicated by tensile tests. Figures showing loss of strength plotted on a time base form an exponential curve; and in a fairly short time from commencement of exposure most of the corrosion that is going to take place will have done so. The period varies with the metal and the conditions of exposure, but usually deterioration of these particular alloys after three to four years will be very slow.

The sampling in this case was therefore well timed, and the results of the laboratory examination and tests provided a clear and reliable pointer to the durability of the roof, which can confidently be expected to remain serviceable for more than 25 years. This period is chosen as representing the expectation of life of a galvanised steel roof, carefully maintained and painted every two years.

On technical grounds the case for aluminium is established as sound; what of the economics? The following figures show a comparison in cost between aluminium and galvanised steel roofing, assuming that the steel will need painting every two years and the aluminium not at all. Other maintenance attention is ignored because imponderable, but it might be expected to be greater for steel.

Cost of mild steel trusses and purlins, and galvanised sheeting	£830
Painting, alternate years for 25 years, at £170 each time	£2,040
Total cost	£2,870
First, and only, cost in 25 years	£1,450

Repainting of the purifier roof every two years is normally found to be necessary; but for less severe conditions painting every four years (six times) may be sufficient. Even so, the total cost in 25 years will exceed that of an aluminium roof by well over 25%; and if the steel roof were painted only four times its total cost would be the greater.

These figures, which are careful estimates, speak for themselves. They suggest there is a strong case for aluminium structures in the environs of gasworks and that consideration should be given to its adoption for the roofing of industrial buildings and warehouses wherever the atmosphere is sulphur-laden or polluted with products of combustion. The precise nature of the pollution should be determined before a decision is reached, of course, but it is a fact that in industrial atmospheres aluminium metalwork generally lasts longer than most.

Flexible Joints for Mains and Services

By S. W. HAYES,

Distribution Engineer, North Devon Sub-Division, South Western Gas Board

From a paper to the Western Junior Gas Association

THE trend in gas distribution practice is towards higher pressures and this means that a limit will be reached for high pressure working with spun iron mains. At present the limit for spun iron pipes is in the region of 50 lb. per sq. in. If pressures are to be increased beyond this figure, steel will have to become the material for gas distribution.

There are records of experiments to find a joint having greater flexibility than the lead joint before the flexible joints we now use were developed. The Croydon Gas Company used a composite joint made with leaded yarn, lead wool, and a rubber ring. Solomon Dresser invented the coupling having his name in 1880, and the Forster joint was an early example of a joint using a rubber ring.

Some of these rubber gaskets have been removed from mains after over 60 years of service and have been found in perfect condition.

Practically all the various types of flexible joints embody the same principle—namely, a rubber jointing ring held in position by a pressure ring. The difference in most joints arises over the method of holding the rubber ring in compression.

Stanton Screwed Gland Joint.—This joint is simple in construction and operation, having proved reliable under all conditions. The rubber gasket is tipped with lead to prevent contact with the contents of the pipeline. The joint will allow a 4° deviation in any direction.

Stanton-Wilson Joint.—This joint is now largely superseded by the other types of joint. It had the disadvantage of needing rather a cumbersome apparatus for tightening the joint as compared with just a spanner.

Stanton Bolted Gland Joint.—This more recent addition to the various flexible joints has the pressure ring bolted through the socket of the other pipe. This type of joint is manufactured for spun pipes of 12 in. dia. and over.

Staveley Bolt Type Flexible Joint.—This joint is of the stuffing box type with hook belts of high tensile cast iron providing the mechanical means of compressing the rubber gasket into the annular space formed between the outside of the spigot and the inside of the suitably shaped socket of the connecting pipes. For gas mains the rubber conforms to B.S. 722:1936, solid rings or rings with a lead tipped nose being provided. The hook bolts are of high tensile cast iron with a minimum tensile strength of 16 tons per sq. in. Each bolt and nut is tested in a machine which subjects it to the stress conditions in the assembled joints. The number of bolts in each joint is such as to enable a compressive load to be applied to the rubber rings capable of maintaining the joint and withstanding the stresses resulting from vibration and subsidence. The joint is designed to permit a deviation of 4° in any direction, and permits elongation when subsidence occurs.

In high pressure mains up to 24 in. dia., the recommended maximum test and working pressure are:—

	Max. Air Test Pressure	Max. Working Pressure
Pipes up to 6 in. dia.	100 lb. per sq. in.	65 lb. per sq. in.
,, from 7 in. to 10 in. dia. ..	75 do.	50 do.
,, from 12 in. to 24 in. dia. ..	60 do.	40 do.

Clay Cross Gland Type Flexible Joint.—This joint is of very simple construction, consisting of a cast iron gland through which specially treated steel set screws pass and enter into drilled and tapped holes in the socket face. The tightening of these set screws compresses the rubber ring between the socket and the spigot. By this method, the distance between the pitch circle of the set screws and the circumference of the rubber ring is reduced to a minimum and thus a more direct pressure is applied through the gland cap on the rubber ring. The rubber ring is housed immediately inside the socket which allows of a maximum movement of the spigot end without breaking the joint.

Ruscoe Pipe Coupling.—This coupling is designed for use with spigot ended pipes, and several uses suggest themselves as being very suitable. Where a number of long spigot ends are available these could be used by joining together with this form of coupling. As the maximum deviation is 12° it would be possible to negotiate slow bends by using two short spigot ends joined with one of these couplings.

Forsym Joint.—This form of coupling is easy and simple to fix, and is designed to couple two spigot ends. As it is not split it is not suitable for repairing a fractured main, unless the main is first cut out and the joint passed over the open ends.

Johnson Couplings.—This type of flexible joint has given good service to the gas industry. It is suitable for steel or cast iron mains and in addition it is possible to use it for connecting a steel main to a cast iron or spun iron main.

With all these types of joints or couplings having bolts for holding the joint in position it is advisable to wrap them with some form of protective wrapping after fixing. This protection will prevent the bolts rusting up and proving difficult to loosen, should the occasion arise, at a later date.

Leak Clamp.—This form of flexible joint is designed to fit over a leaking lead joint and form a permanent seal. With the increase in volume and weight of traffic over many of our roads the consequent vibration has caused many of the old lead joints to leak. This type of fitting effects a repair which will allow for subsequent vibration and maintain the lead joint gastight over a number of years. The joint embodies a rubber ring held in position by a pressure ring which is made in segments to facilitate fixing in position round the joint. The pressure ring is held in position by bolts through a ring fixed behind the socket of the joint.

Expansion Joint.—Where mains are laid above ground level, over or alongside railway bridges or road bridges they are subject to expansion and contraction caused by variations of the atmospheric temperatures. To take up the movement of a main caused by such expansion or contraction some form of expansion joint must be used. Such expansion joints are usually forms of flexible joints having provision for the main to expand into or contract out of a sleeve in the form of a stuffing box.

Another form of flexible joint for this purpose is the bellows type of expansion joint.

I would here refer to some experience gained in the laying of an 18-in. steel main alongside an electric railway line. Where the main was laid along the embankment the main was carried on piles and brick piers as excavation might have caused movement of the track. To allow for expansion it was decided to use special joints to take up the movement. These joints were made with a rubber ring at the back of the socket and the remainder of the joint was caulked with lead wool, as hot run lead would have damaged the rubber. It was anticipated that each joint would take up a proportion of the expansion of the main.

When the main had been completed it was found during the following summer, when temperatures rose very steeply, that these joints were not sufficient to take up the amount of expansion taking place. It was necessary to cut out the main at intervals of approximately 250 yards and insert an expansion joint of the sliding type. When this work had been completed no further trouble was experienced.

There is one aspect of the flexible joints that I feel should be emphasised—the ease with which they can be uncoupled. It is a comparatively simple matter to loosen the joint and remove either a single pipe or a length of main. This aspect renders the laying of a temporary supply a simpler matter than would be the case with lead jointed main.

One of the applications of this point concerns the clearing of mains choked with rust, etc. By isolating the main in sections and clearing these sections with rods, the flexible joint provides a quick method of reconnecting the sections after the clearing operations are completed.

From experience I have found that water at district pressure in conjunction with rods to loosen the rust in the main will carry away most of the rust lying in the bottom of a main.

Flexible Split Collars.—As the open lead joint has been superseded by the flexible joint so I anticipate will the old type of split collar with lead joint be superseded by the split collar with flexible connections. The saving to be effected is considerable. since no lead or yarn is required nor is it necessary to employ any form of fire for melting the lead. After the excavation has been done, and less excavation is necessary there being no caulking to do, the flexible split collar can be fitted in something like 30 min. This fact is very important in dealing with emergency work where overtime is being paid. Where broken or fractured mains occur, as may be the case over a wide area after severe frost, these may be repaired immediately by the gang sent to deal with the escape. Formerly it was often necessary to find the cause of the escape, wrap the fractured main with a protective wrapping, and leave the job to be dealt with at a later date.

Unfortunately, this means excavating the trench a second time, and there is the risk, if the work is delayed, that the surface may be reinstated meanwhile. Furthermore, if the repair is completed in the first instance there is less disturbance to traffic, an important aspect in large towns and cities.

These flexible split collars are useful where large services of 1½ in. and 2 in. dia. are connected to 4-in. or 6-in. mains. The service layer capable of undertaking this class of work can also be trained to fit these collars and the scope of the work is lessened since no lead melting is required and no caulking is necessary, and the time taken is considerably less.

Asbestos Mains

The great difficulty now being experienced with the delivery of spun iron main, the period now being 3½ to 4 years between the date of order and delivery, caused thoughts to be turned to other materials for gas mains. Some few gas mains have been laid using asbestos pipe in different parts of the country, but the material has not been generally accepted. The pipes are manufactured from Portland type of cement mixed with best quality asbestos fibre. The method of jointing is by a flexible joint embodying a rubber joint.

Simplex Joint.—This is composed of a collar of the same material as the asbestos pipe with two rubber rings. To ensure that the joint remains in its correct position the face of the joint is filled with liquid cement or a mastic material. It is difficult to see, should there be any movement of the joint through vibration or slight subsidence, what would prevent this filler from breaking away from the joint.

Gibault Joint.—This type of joint is made of a cast iron collar piece and two flanges. Two rubber rings are held in position by the flanges bolted up to the collar piece by mild steel nuts and bolts. To ensure a tight joint the ends of the asbestos pipes are machined for a sufficient length to accommodate the flexible joint.

One of the great disadvantages of asbestos for general gas distribution work comes when services are to be connected. The asbestos pipe is not suitable for drilling and tapping in the normal way, and it is necessary to use a saddle piece to make a service connection. This, of course, adds to the cost of the main as compared with spun iron pipe.

From the information I have it would appear that the cost of asbestos pipe exceeds the cost of spun iron main. For example the comparative cost of 6 in. dia. main is as follows:—

	per yard
6-in. spun iron main including joint ...	18s. 5d.
6-in. asbestos main including Gibault joint	21s. 7d.

Moreover, there is the additional cost of a service saddle piece for every service connected.

General Conclusions

The flexible or mechanical joint has had a marked effect on mainlaying work generally. Together with the increased use of mechanical aids such as compressors for road breakers, power rammers, trench excavating machines, etc., the flexible joint has speeded up the work of main laying very considerably. Furthermore, certain economies are effected in the cost of the work in the following ways:—

(1) Less equipment required—no caulking tools, leadpots and ladles, yarn, etc.

(2) Less labour required since no caulking is necessary, no lead boy, joint holes have not to be so large, and work does not depend so much on the vagaries of the weather.

(3) Less skilled labour required as the operation of making the joint is well within the capacity of semi-skilled labour.

Once the main has been properly laid the maintenance cost will be less than the lead jointed mains since the joints are less likely to leak even where traffic vibration is considerable.

There is one last point on which there would appear to be some divergence of opinion—I refer to the use of graphite in making the joint. There does not seem to be any point in smothering the rubber ring with graphite paste except perhaps in those cases where the rubber ring will not slide easily into position. When working in particularly dirty or muddy conditions the chances of the graphite picking up dirt, grit, or other foreign matter increase the possibility of these undesirable elements finding their way into the joint.

The use of flexible joints in service laying work is one of recent development—much of the pioneer work having been undertaken at Liverpool. This method has many advantages over the more conventional methods in use and when once the workman has become used to the method and familiar with the fittings, it can help to speed up the work of service laying. One important advantage is also worth while mentioning—that is the benefit to the employee. The normal service layer works in live gas and, as the result, the end of the day sometimes finds him with a headache or measure of lassitude. Using this new method does mean that most of the work is done without live gas and the employee feels fresher at the end of the day.

DISCUSSION

The **President** (Mr. O. Pincock, Weston-super-Mare) said his experience with asbestos mains was negligible, but the asbestos main had a smaller carrying capacity than a similar size spun iron main and in the smaller sizes this was a consideration with a reduction of 12% for 4 in., and 14.4% for 6 in., and with 12 in. rather less at 7½%. Certain manufacturers favoured particular section rubber joints, some square and some wedge shaped, and he would be interested to hear Mr. Hayes' opinion. There was no doubt that where a hook bolt type of joint was employed greater stress was placed on the bolt by the bending moment than straight tension. What was the safe distance, having regard to vibration, that this type of joint could be laid from a railway line?

Mr. Hayes replied that the section of the rubber joint did not appear to have any great bearing. In his experience all rubber joints proved satisfactory in use. The possibility of die cast bolts was under consideration by manufacturers. He had experience of mains laid within 3 or 4 ft. of a railway track without the vibration having caused leakage.

Mr. E. Dunn (Clevedon) stated that in his area a considerable mileage of mains employing Stanton-Wilson and screwed gland joints and originally laid as low pressure mains had subsequently been converted to high pressure employing pressures up to 25 lb. per sq. in. with every success. In the Dunster area the Water Board had employed a 2 in. asbestos water main to cross mountainous ground where soil conditions were particularly bad. This main had proved quite successful, but particular care was necessary when laying to ensure that the bottom of the main had a secure bearing.

Mr. S. B. Jones commented that the asbestos main Mr. Hayes referred to was being replaced with a larger main. The main had never given any trouble though it had been subjected to very heavy traffic conditions.

Mr. O. H. P. Hammond (Exeter) felt it was not good policy to smother the joint ring in graphite paste, which should be applied only to the back of the ring.

Mr. Hayes said it was difficult to decide whether the whole joint ring should be covered in graphite. It might well be that in certain cases its lubricating qualities would assist in ensuring even compression throughout the joint.

Mr. F. Tweedle (Swindon) asked for information regarding comparative costs of service laying using flexible fittings.

Mr. Hayes replied that a saving in labour was achieved, but services were so very varied in character it would be most difficult to substantiate a claim with figures, unless similar conditions were observed in cases of comparison.

Mr. A. R. Langford (Plymouth) pointed out that where a rotating type joint was employed it was essential to use graphite as otherwise puckering of the rubber would ensue. With this type of joint it was advisable to run it up hand tight to bed the rubber ring and then to undo the joint and apply the graphite. In his experience when graphite was not used leaks usually occurred.

Mr. F. G. Craxford (Taunton) said that in all jointing, especially where paste was employed, cleanliness was of first importance. He could not stress too strongly the use of flexible connections for services.

Mr. K. G. Pemberton (Torquay) instanced a housing estate where leaks had developed in a 4 in. cast iron main and a 4 in. asbestos main, due to subsidence of made-up ground. Within the same section the asbestos main broke in four places, while the leaks on the spun iron main were occasioned by two lead joints which had been pulled. So far as flexible split collars were concerned a definite saving could be effected as less labour was required, less reinstatement was necessary, and no lead had to be provided. An improvement of tee piece with flexible joint could be effected by providing these as angle branches of, say, 45°, which would facilitate service laying at depth and in clearing in the future.

Mr. A. G. Holtham (Cheltenham) moved a vote of thanks to Mr. Hayes for his paper.

MODERN RETORT HOUSE CONTROL

By C. P. ASTBURY, M.Eng., Assoc.M.Inst.Gas E.
Windsor Street Works, West Midlands Gas Board

From a paper to the Midland Junior Gas Association

THE retort house to which this paper applies consists of four settings, locally known as ranges, of Woodall-Duckham continuous vertical retorts, as follows:—

66-62 in. upwardly heated retorts in two benches of 30 and 36 retorts respectively.

44-59 in. downwardly heated retorts in two benches of 20 and 24 retorts respectively.

40-82 in. lambently heated retorts in two benches of 20 retorts each.

56-103 in. upwardly heated retorts of two benches of 28 retorts each.

The settings are arranged in parallel and are connected by two foul gas mains, one along each side of the retort house at right-angles to the settings, with connections to each quarter. At one end of the house the two mains turn inwards and join at a tee, the leg of this tee, a 48 in. main, thus taking the entire coal gas make from the house. This main connects into one end of another 48 in. main having five branches leading to five Cyclone tar extractors from which the gas passes through five primary water cooled condensers. On the outlet of condensers the gas stream again splits into two and passes to the electrostatic detarrers and exhausters. At the other end of this 48 in. main the gas stream is joined, through a 12 in. branch and valve, by producer gas generated in one Power Gas 9 ft. producer plant.

Coal handling is by gravity bucket conveyors and elevators from the crushers to the end of each range, distribution along the ranges being by tipping tray conveyor. Coke for producer firing and retort charging is brought direct from the screens by belt conveyor and is similarly elevated by other gravity bucket conveyors and elevators for distribution by the tipping tray conveyors. Both sets of gravity bucket conveyors and elevators are interchangeable between coal and coke to avoid interruption of work due to breakdowns.

Coke from the retorts is discharged into skips carried on electrically operated chassis which convey the skips outside the retort house from where they are picked up by overhead crane. The skips are then either elevated by crane direct to distribution hoppers on top of the screens or emptied into a receiving hopper at ground level feeding a lip bucket elevator which carries the coke direct to the screens.

Coal Distribution

Coal to be carbonised is allocated by the Board Coal and Transport Officer, the two allocations per year covering the six summer and six winter months. An average allocation for the works would be 30% Yorkshire and 70% Notts and Derby, with swelling numbers varying from 1½ to 8. To help maintain uniform carbonising conditions, an 'Allocation of Coal to Ranges' list is prepared with the aim of allocating coals of similar swelling numbers to the various ranges which are considered most suitable to handle them—*e.g.*, coals of a low swelling number are allocated to the downward heated setting.

When all ranges are at work the coal carbonised is in the region of 1,500 tons per day. The allocation list cannot always be adhered to because frequently as many as 25 different descriptions of coal may be elevated in one day. In such cases, when it is difficult to avoid a sudden change in coal type on a particular range, extractor speeds are varied in anticipation of the change in an effort to secure uniform travel of the charge.

Apart from the advantage of uniform carbonising conditions this system helps to ensure a reasonably constant quality of coke and enables two types of coke to be made, an industrial and a domestic, the more reactive domestic coke being obtained from the ranges carbonising the lower swelling number coals.

All coal is rail borne and coal examinations are carried out frequently; any trucks the contents of which, by appearance, would seem to differ markedly from the accepted standard are sent to the central test works. Full details of all coals carbonised, such as swelling number, ash, moisture and sulphur content, etc., are provided by the test works, and it is thus possible to have some idea of the behaviour of all coals while carbonising. The test plant also gives each coal an estimated thermal yield per ton which would be obtained from that coal if carbonised in a horizontal retort, the actual test being carried out in a cronite retort of a small scale test plant. These figures provide a method of comparison of carbonising results as, at the end of each week, a calculation is made to estimate from the test works yield what the average thermal yield should be for that week. The actual therms obtained are then expressed as a percentage of the estimated test plant figure.

Carbonising Temperatures

Particular attention is paid to the maintenance of correct carbonising temperatures and a heat attendant is available at all times, as the men on rotating shift relieve one another. Over the normal seven weeks cycle each heat attendant works one week on each of the morning, afternoon, and night shifts, and three consecutive weeks on an 8 a.m. to 4 p.m. day shift. This allows for one heat attendant on each shift and one on each range during the day, together with a relief man. When on days, each man normally works on the same range for three consecutive weeks and then moves to shift work, his place being taken on that range by the heat attendant coming off shift. Thus each range is the responsibility of two heat attendants.

The shift heat attendants' duties include the shutting down and putting to work of scurfing retorts, the supervision of producer firing, and the maintenance of correct pressures, attention to waste gas pull conditions, and inspection of waste heat boilers, particularly in relation to their inlet temperatures. He is also available to carry out any temperature adjustments which may be necessary owing to alteration of extractor speeds, breakdowns, or even the standing of a range which may occur outside the day shift. At times of heating-up a range from cold the shift heat attendant is available for the reading of setting thermometers and the supervision of the firing of the slow fires outside normal day hours.

To the day heat attendant falls the responsibility of maintaining correct carbonising temperatures on his range, and temperature surveys are taken by him each day, using an optical pyrometer. To ensure that these surveys are accurate each heat attendant is tested in the reading of his pyrometer at regular intervals and his instrument checked against a standard.

Heat attendants are given definite combustion chamber temperatures to work to, with a tolerance in either direction. In the case of the upward and downward heated settings the maximum temperatures are $1{,}370° \pm \begin{matrix}20°\\30°\end{matrix}$ C. with the top temperatures in the region of 1,150°C. In the case of the lambently heated settings the maximum temperatures are $1{,}350° \pm \begin{matrix}20°\\30°\end{matrix}$ C. with a maximum of 1.160°C. in the top pass.

In a retort house of this size it is difficult to obtain an overall picture of the temperature conditions prevailing at any one time merely by reference to the temperature survey sheets completed by the heat attendants, and to overcome this difficulty a board, termed the 'carbonising control chart,' was introduced and fixed to the wall in the heat attendants' room. Alterations to the control chart are carried out by members of the technical staff only, from information provided by the heat attendants' temperature survey sheets.

This chart has been found to be particularly useful, as apart from indicating the temperature conditions prevailing throughout the retort house, the condition of the retorts and the amount of repair work being done can be seen at a glance. The chart is also of value to a heat attendant taking over a range either as a relief or when changing over from rotating shifts, as it enables him to see immediately which retorts require attention. Similarly, the shift heat attendant, especially the night man, can see if any retorts require attention during his shift.

Gas Quality and Quantity

The method of control of quality and quantity of gas made in the retort house depends very largely on whether or not the producer plant is at work—*i.e.*, whether winter or summer conditions prevail.

In winter, particularly under peak load conditions, the coal gas plant is worked at as high a throughput as possible commensurate with satisfactory coke quality and no attempt is made to control the coal gas calorific value. Producer gas from the mechanical producer is added to bring the quality down and under high peak conditions maximum possible diluent may be added, thus bringing the mixed gas calorific value down to as low as 420 B.Th.U. Under such conditions the carburetted water gas plant, consisting of 3 mill. cu.ft. per day machines would be at work making gas at a quality in excess of 500 B.Th.U. so that the final mixed gas or inlet holder calorific value is kept at a declared value of 450 B.Th.U. Any reduction in demand, as at week-ends, can be met by shutting down one or more C.W.G. machines and reducing the amount of diluent added to maintain a 450 gas at inlet holder without the necessity of altering the retort house conditions. The retort house can thus be worked as a base load plant throughout the winter months.

In summer the producer plant is normally shut down, during which time it receives an annual overhaul, and during this period control of total gas make and quality is by variation in throughputs and percentage steaming. Owing to large variations in the types of coals carbonised, some of which are not good steaming coals, it is often difficult to keep the quality at the declared calorific value without so reducing throughputs that the required makes are not maintained. In this case the water gas is worked at a quality sufficiently low to maintain the final mixed gas at the declared value.

Inerts and Gas Sampling

Crude gas is drawn from the foul main by a vacuum pump, at a point on the leg of the 48 in. tee mentioned earlier—*i.e.*, near the inlet to the Cyclone tar extractors, but prior to the introduction of the producer gas. The crude gas is collected over mercury by a 24-hour clock sampler, provision being made for a 48-hour sample to be collected over the week-end. The sample is tested by Orsat apparatus and serves to give a general indication of carbonising conditions such as efficiency of steaming and inert content.

To obtain an overall picture of conditions prevailing, the 24 hour gas analysis is plotted daily and a target is set for each of the inert contents of the gas. These are as follows:— Total inerts, 8.5%; CO_2 and H_2S, 4.5%; O_2, 0.2%; N_2, 3.8%.

The collected sample from the whole house has the advantage of giving only an overall indication of conditions, and a range which may be steaming badly or producing a gas with a high nitrogen content may be masked by other ranges giving a good analysis.

The arrangement of foul mains allows samples to be taken from each quarter range only and any increase in total inerts is investigated by taking spot samples from the quarter ranges. While it is admitted that these spot samples have limitations, they do enable a check to be made as to whether or not each range is giving a satisfactory analysis.

Gas analyses are carried out by a member of the works chemical staff operating from a small laboratory situated in the retort house. This chemist carries out the analysis of the 24 hour collected samples of coal gas and producer gas from the mechanical producer and is always available to carry out analyses of crude gas from the quarter ranges, pro-

ducer gas, or waste gases at the request of the retort house staff.

An excess CO_2 is rectified by attention to retort temperatures or if necessary reduction in the steaming rate of the range affected.

An oxygen figure of 0.1% has been maintained by close attention to grouting of top mouthpiece castings and the general condition of the top ironwork, particular attention being paid to off-take pipe joints, coal valves, and rodding hole plugs.

The arrangement of foul mains, which necessitates each quarter range being fitted with an Askania regulator, enables pull conditions to be very closely controlled and helps towards maintaining a satisfactory oxygen content in the crude gas.

The nitrogen figure depends almost entirely on the condition of the bottom ironwork and when any range shows a high nitrogen figure the bottom ironwork is carefully inspected. Should a visual inspection not reveal the cause of the air leakage the ironwork is tested with the retort under coal gas pressure by checking the gas off-take valve for a short period. Escaping gas indicates immediately the point at which air is being drawn in, usually at the joints between the casting or through cracks in the castings themselves. Any such defects receive immediate attention, either by pointing-up the joints, welding the cracks, or in bad cases replacing the defective casting.

Labour

Under present-day conditions it is extremely difficult to maintain a satisfactory labour force in a retort house, and the following system has been found to make the best use of the labour available.

Men for the retort house are normally recruited direct from the Labour Exchange, through the divisional labour office and the works labour foreman. All new starters are given training in both coke extracting and fireminding as they may be required, as junior men, to do either job. The training is carried out by established men who have undergone a short course in instructing under the Training Within Industry scheme. Each new entrant is given three shifts with an instructor who actually performs the job, during which time the learner receives a learning rate and his instructor receives 1s. extra per shift. After three shifts a man is normally capable of doing the job himself and if he is satisfactory he is passed out by his instructor and then receives the rate for the job. Should the man prove unsuitable for retort house work, this is usually apparent before the end of the third shift and he is returned to the labour foreman, who either discharges him or finds other more suitable work if available.

When a new entrant has completed 12 months continuous service in the retort house he is entitled to a place on the agreed seniority list, which is kept to ensure that the senior men are given the higher paid jobs, and if found suitable may be trained for top work—*i.e.*, retort charging and rodding—in a similar manner to his initial training. A strict seniority rule is worked with regard to the appointment of top men. There are three classifications of men working on top—chargehands, the highest paid, who are in charge of other men and plant; leading stokers; and top men. The strict seniority rule applies only to top men and leading stokers, chargehands being appointed by ability alone.

A very high labour turnover exists on the works in general and more particularly in the retort house. Most of the turnover is among firemainders and extractor men—*i.e.*, the junior jobs—as it is found that if a man will stay sufficiently long to gain a place on the seniority list he will normally stay in his job. The direct labour requirements with all ranges at work, is 126 men, and to obtain this labour force during 1951, 119 new men were started, of whom no fewer than 88 left before they had been completely trained. Only 12 left after having finished their training, two were transferred to other jobs, leaving a net gain of 17 men, or just over 14% of the total starters.

Records to date indicate that the figures for 1952 will be very similar, despite the efforts of the labour office to screen the men sent to them from the Labour Exchange. New schemes in hand aim at improving the working conditions, which it is hoped will help to reduce the number of men who leave before becoming fully acquainted with the job.

Under this heading can be included the flue cleaners and gun team who work under a chargehand who is generally responsible for the gas-tightness of all working retorts, the cleanliness of all flues, and the efficient operation of the two gangs.

Apart from the normal flue cleaning carried out at scurfing times the flue cleaners are responsible for the general cleanliness of the setting between the charging and the producer stages.

The majority of the mechanical maintenance in the retort house is carried out independently of the works fitting shop by a gang of retort house fitters and pipe fitters working under a chargehand. Three of the fitters are formed into a casting gang who concentrate almost entirely on top and bottom ironwork.

DISCUSSION

Mr. K. J. Crane (Birmingham) asked whether size was taken into consideration when allocating coals to ranges and also how long the gun team was left on that class of work. It was heavy work and he wondered if two years would be considered sufficient.

Mr. Astbury said they had no fixed time for men to remain on gun work. Some had been engaged on it for a number of years. As to coals, they got a large number of different types and the coals were allocated by swelling numbers only. If a sufficiently large amount of one size of coal was received throughputs might be varied to suit it.

Mr. R. N. Hateley (Walsall) said they were all conscious of the need of organising information and it was very interesting to see how the job was tackled at Windsor Street where they had so many retorts, and to know how the information was kept so that it could be referred to easily. It must be a unique experience to have so many different types of retort under one's supervision, and he would like to know if it was found that certain of the ranges were capable of handling smalls easier than others; was it preferred, if they had the choice, to use the small coal on the lambent or the downward heated retorts?

Mr. Astbury replied that this would depend on the swelling number of the coal concerned, but the downward heated setting had been found to handle smalls satisfactorily.

Mr. A. R. Myhill (Birmingham) said the paper showed how to solve the vexed problem, which was a problem at Windsor Street, of systematising the work in a large retort house with such different patterns of retort. He thought it was an admirable idea to take the 24 hour samples and make examination for inerts. He would suggest, however, that these tests should be routine on quarter ranges. Bad working of the order of 6% might be masked by the other 94%.

Mr. Astbury said that they did carry out routine spot tests on quarter ranges as well as when conditions were suspect. On occasions collected samples had been taken on quarter ranges in order to get a better idea of conditions.

Mr. N. Calvert (Nottingham) enquired how the calorific value of the coal gas was arrived at when it was mixed with producer gas immediately it was made.

Mr. Astbury replied that the amount of producer gas admitted was metered and its quality recorded so that the coal gas calorific value could be calculated.

Mr. F. C. Barker (Birmingham) enquired as to the effectiveness of gunning as compared with welding.

Mr. Astbury said that gunning was found to be most useful to repair any large holes in retorts, although usually welding was used to complete the repair. The majority of the repair work was effected by welding.

Mr. I. F. Millar (Dudley) asked if any attempt was made to take care of specific gravity and also if any figures were available as to the optimum size for producer fuel.

Mr. Astbury said that specific gravity did increase at times of high load, but the variations were not excessive. As to producer fuel they used screened Nos. 1 and 2 coke.

MAINS EXTENSIONS AND HOUSING DEVELOPMENT

By R. PRATT, Assoc.M.Inst.Gas E.
Taunton Sub-Division, South Western Gas Board

From a paper to the Western Junior Gas Association

THE planning of the main systems for new housing developments is becoming a more technical and complex procedure due to the tendency to develop estates on a much larger scale than before and the necessity to design the main sizes and layouts to provide an adequate supply of gas to all consumers at the lowest capital cost. I therefore set out in general principle some of the methods that can be used to solve the design problems encountered on housing estates in provincial areas together with some observations on the effect the modern trend of housing development has on the gas industry.

Planning

The local planning authorities have the responsibility of estimating the housing needs in their respective areas and have to determine the number of houses required for the immediate needs of the existing population, plus the rehousing of people moved from slum clearance areas and finally arrive at an estimation of the ultimate increase in population. The general areas scheduled for housing development have been decided in the initial stages and to determine the sizes and positions of the new estates the calculations are based on the figures of 30 persons per acre and 3.4 persons per house. Most authorities have plans of the areas for future housing development and are usually in a position to give a good estimate of the proposed housing programme for at least five years, and a provisional estimate up to 15 years in advance. This will enable a distribution engineer to plan well ahead for the probable development in his area.

The tendency these days is to plan large or medium large towns on the principle of neighbourhood planning which is the sub-division of the town into a number of neighbourhoods each containing all the public services and amenities to enable it to act as a self-contained unit as far as community centres, shops, assembly halls, schools, etc., are concerned. These developments usually occur at the extremity of the existing distribution network which may necessitate the redesign of a portion of this system or the laying of medium or high pressure feeders to provide the new areas with an adequate supply of gas. Close liaison with the planning authorities in the initial stages will enable new extension or improvement of supply schemes to be well past the planning stage before the final estate plans are approved.

Gas Service

When the final layout plans have been settled copies are forwarded to the local gas offices together with information regarding the type or houses to be erected and the anticipated date of commencement. In regard to the provision of a gas service to these estates it is the practice of some local authorities to give their tenants freedom of choice for gas or electric cooking and it is our experience in these instances that the number requesting gas is over 75%. Other authorities lay down that 50% of the houses will be allocated for gas and 50% for electric cooking; this obviously does not give complete freedom of choice to a proportion of the tenants. The general principle in the Taunton Borough is that if a tenant is allocated an electric house but requires a gas cooker or *vice versa* the authority will give permission to change from one service to the other on the condition that the tenant provides and installs the appliances at his own cost.

By arrangement the houses are provided with a gas installation to a minimum of four points, which will allow, in the case of houses allocated for electric supply, gas apparatus to be installed without the necessity for extra cost to the consumer in running the required gas point.

The gas consumption on these estates is dependent on the number of connected consumers; and these numbers either have been provided by the local authority in the case of 50/50 estates or have to be estimated in the initial stages for 'freedom of choice' estates. These figures have a particular significance when a feeder main has to be laid to the entrance of the estates; and maximum hourly gas flow is based on a figure of 70% gas consumers for 50/50 estates and 85% on 'freedom of choice' estates. These percentages will vary in different areas in the light of past experience, but they do provide a foundation for the initial planning.

Economic and Practical Problems

The architects who design the layouts of the estates plan to provide the dwellings with the maximum amount of space, light, and air consistent with modern standards, with wide sweeping roads, long house frontages and adequate garden spaces. This presents the engineer with economic and practical mainlaying problems that were not so apparent in the pre-war type of estate. The wide roads designed on artistic patterns and curves present difficulties to the mainlayer, who, provided with straight lengths of spun iron pipe and standard specials, has to maintain a set position in the curved footpaths relative to other public utility services.

The long frontage of houses and large garden spaces increase the length of main and service pipe per dwelling thereby increasing the capital charges and the distribution cost per therm. This increased expenditure per dwelling, coupled with the high cost of labour and material, is tending to make the gas supply to some estates an uneconomic proposition; and as it is the practice to supply each consumer initially with only a cooker and wash-boiler the anticipated consumption of gas does not always provide sufficient revenue to cover depreciation and capital charges. The remedies for this are:—

(1) To increase the gas consumption per consumer and number of appliances per dwelling.
(2) To reduce the costs of providing a supply of gas to the estate.

The first remedy rests primarily in the hands of the sales department, but it is to be remembered that every member of a gas board staff is a potential salesman and every effort should be made to encourage people to be gas-minded. Only by informing the authorities of any new developments in gas appliances, arranging demonstrations and keeping close contact with local architects can the gas point of view be kept constantly in the forefront.

The second remedy is based on reducing the cost per yard of main and cost per service laid. To lower the labour costs a greater yardage of main must be laid per man-hour and to this end the general use of mechanical joints has increased the speed of laying, but taking the operation as a whole the greater period of time is taken up by the excavation and backfilling. How then can this time be reduced? Let us consider first the use of mechanical equipment—*i.e.*, mechanical excavators, calf-dozers, and power rammers. These are undoubtedly time savers, but they can only prove an economic proposition if long lengths of main are to be laid and the sites are sufficiently clear of building material and underground services to warrant their use. These conditions are rarely encountered in practice as the shortage of men and material frequently makes the laying of great lengths of main a practical impossibility. The present practice due to short-

(*Continued on p.* 515)

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age of pipes, is to lay only sufficient amount of main to keep pace with the development of the estate.

The stacking of building materials on site, usually on the proposed line of main, is a problem encountered on many estates and can involve additional expenditure in either removing the obstruction or waiting for it to be moved. This can be avoided by co-operation with the clerk of works, who can be either your best friend or your worst enemy but is usually a combination of the two. He can, however, usually be persuaded to keep all material well away from the path-line to allow a clear route for the mainlaying.

Co-operation with other utility services is another factor that can affect costs, as in some instances the use of joint trenches can be advantageous to all concerned. This is somewhat nullified by the varying depths allocated to utility services, but we have found that by working in close liaison with the local water department a common trench can be excavated to the gas main level and the water main trench deepened to the required level after the main is laid.

To increase the output of work per man today the need has arisen for an added incentive, and for some time we have laid estate mains on a piecework basis. It has been found that the yardage of main laid per man is increased, showing not only a corresponding decrease in laying costs, but a saving in manpower. It may be argued that a greater measure of supervision would be required to ensure that the main is laid correctly and at the specified depth, but we have experienced no trouble in this direction.

The basis of payment is by the yard for excavating, laying, and backfilling to an agreed cover of 2 ft. 3 in.

As far as service laying is concerned, although it has been tried it is not considered practicable to place this on a piecework basis due to the variable conditions encountered as far as depths and continuity of laying on one estate are concerned.

Single and Dual Main Systems

To economise in material and with a view to reducing costs, attention has been directed to the economics and practical advantages or disadvantages of single main systems as opposed to dual main systems. The laying of services across the carriageway obviously has to be undertaken before road construction commences, and in many cases the services would have to be laid dead and at a depth dependent on the construction of the road. As the depths of the modern type of concrete or asphalt road are anything up to 1 ft. 9 in., and after allowing for the necessary 6 in. of earth covering over the pipe, the cover will finally be in the region of 2 ft. to 2 ft. 3 in. This cover will determine the depth of the spun iron main, which will be in most cases greater than the dual main system. With cross-road service the costs of excavation and reinstatement for renewal and repair at a later date is liable to be heavy, but this can be reduced by laying trunk services to groups of consumers instead of providing each house with an individual supply.

It would appear that considerable initial saving could be effected on the single main system, but against this an additional yardage of steel tube would have to be laid for the cross-road services.

As the single main has to carry a greater quantity of gas due to the addition of the far-side consumers, it is readily seen that the length of main laid of a given size for a given pressure loss will be considerably reduced as compared with the dual main system, and that over a certain limit the main size would have to be increased. It is at this limiting point when main of an increased diameter has to be laid that the costs of the two systems move closer together.

Estates of up to 60 consumers completed with single mains have proved to be initially cheaper. Generally speaking it would appear that estates up to 100 consumers would be cheaper utilising single mains, but over this number the costs would move closer together due to the use of main of a larger diameter.

On estates where service governors are not installed the allowable pressure loss must be reduced to a minimum and should not exceed 0.5 in. W.G. on any one street main. If it is the policy to fit service governors as an integral part of the house installation, the allowable loss can be greater as the governor has the capacity to compensate for large variations in pressure and in this case the allowable loss should not exceed 1 in. W.G.

Mains on estates are designed to deal with the maximum peak rates of flow plus any future increases and developments anticipated. This maximum peak rate and the maximum hourly rate are factors which have an effect on the distribution costs, as high hourly, daily, and seasonal variations give a low load factor with the necessity for large mains and pressure-raising plant at the works.

The load factor distribution, which is the average hourly sendout divided by the maximum hourly sendout, can be expressed as a percentage for a year or for a 24-hour period, and the nearer the average rate is to the maximum rate the higher the load factor and lower the cost of transmitting a therm of gas.

The load factor of a modern housing estate is low, as generally the chief load is cooking and wash-boiler heating. This can only be raised by the increased sale of gas for other uses—*i.e.*, water heating, space heating, etc.

To ascertain the maximum rate of flow per consumer, surveys can be carried out on similar estates in the area and the maximum demand per consumer for various estates ascertained. Alternatively a table of consumptions that has been completed for various groups of consumers can be used. The figures show the effect of diversity for groups of consumers and the consumptions are sufficiently high to allow a margin for increased consumption at peak periods—*viz.*:—

Up to	10	consumers	100	cu.ft.	per hour.
„ „	20	„	70	„	„ „
„ „	70	„	40	„	„ „
Over	70	„	30	„	„ „

DISCUSSION

The President (Mr. O. Pincock, Weston-super-Mare) commented that the author had referred to the carcassing of houses and had said that they should be provided with a minimum of four points. Mr. Pincock suggested that it cost approximately £30 per house, and quite a considerable amount of this was taken up in carcassing. He had recently enquired how many points were used in a number of houses, and in only six was there anything other than a cooker and a wash-boiler. Could Mr. Pratt express an opinion on the economics of putting in more than two points per house? It had occurred to him if manufacturers put two sockets on specific lengths of pipe it might save money.

Mr. Pratt replied that in the Taunton Borough in some cases there was a cooker and in some a cooker and a wash-boiler. The consumption varied from 98 therms to 125 therms per annum. The reason for putting the points in before the house was occupied was that they were then available later if required and money would be saved at that time. In many cases sales would not be made if at a later date the installation of additional apparatus required supplies to be laid with all the attendant upheaval in a house.

Mr. J. W. Denton (Torquay), referring to joint services, said it should be remembered that in 10 years time someone might clear a service with a force pump. He suggested that where joint services were laid enamel warning plates should be fitted close to the maintaps.

Mr. B. G. Hawkings (Plymouth) said that at Plymouth a change in building construction was being experienced. The old idea was semi-detached houses, but now houses which were called 'people's houses' were being erected which might alter distribution problems. The houses were appearing in groups and the overall frontage on them was about 15 ft. The local Council was also going ahead with the construction of flats. Co-ordination of services at Plymouth was proving most successful. There now existed a set routine and no difficulties were experienced.

Mr. F. W. Sansom (Exeter) felt that joint trench schemes had everything to recommend them.

Industrial Pyrometry

By H. J. SMITH, A.M.I.Mech.E., M.I.Prod.E.,
Managing Director, Industrial Pyrometer Co., Ltd.

Paper to the Midland Junior Gas Association

TEMPERATURE is a most elusive variable and is not so easy to define or measure as other physical properties, such as length and weight, for example. Although the International Temperature Scale, with its primary and secondary points, is well known, it is often overlooked that accurate temperature measurements should be made under conditions of thermodynamic equilibrium.

Fortunately, in industry, one is more concerned with the consistency of the results obtained than with the intrinsic accuracy of each individual part of the temperature measuring system and, in practice, the ideal is quite closely approached.

Pyrometers may be classified into three groups, according to the nature of the temperature measuring element. This may be a thermocouple, a resistance bulb, or a radiation unit. The choice will depend on the temperature range of the instrument, the operating temperatures, the type of process plant, and the function to be fulfilled by the pyrometer. By far the largest number employ thermocouples, which are produced in a variety of types to suit many different applications.

Thermocouple Pyrometers.—In 1821 Seebeck discovered that if two wires, one of copper and one of iron, were joined together at both ends and one junction was heated, an electromotive force was generated and current would flow from the copper to the iron wire. The current increases with increase of temperature, so that a thermocouple can be likened to a small self-generating battery brought into action by a change of temperature. It must be appreciated that the electrical power generated is very small indeed. Thermocouple pyrometers of present-day specification will give maximum deflection for one-millionth of a watt. Yet this sensitivity to small electrical energy changes can be combined with a robust industrial pyrometer of simple design, consisting of an instrument and thermocouple with its connecting cable.

Thermocouples.—Important thermocouple characteristics, other than that of high electromotive force, are reproducibility, linear variation of electromotive force with temperature change, and high resistance to oxidation and corrosion. Since these requirements are not easy to satisfy, very careful selection of thermocouple materials should be made, according to the application, from three principal types in industrial use.

Widest Application

The chromel-alumel thermocouple has widest application (chromel: 90% nickel, 10% chromium; alumel: 94% nickel, 2% aluminium, 3% manganese, and 1% silicon) since it can be used from sub-zero temperatures up to 1,100°C. for continuous immersion, and 1,300°C. for intermittent use. With high nickel content the chromel-alumel thermocouple resists oxidation and corrosion, but is seriously affected by reducing atmospheres, and those containing sulphur, carbon, and hydrogen. For temperatures exceeding 600°C. an inner porcelain sheath will give extra protection from gas attack, the outer sheath of mild steel, chrome steel, or nickel chrome alloy providing mechanical strength.

Where reducing atmospheres are encountered, or carbonaceous gases, such as experienced in cyanide salt baths, the iron-constantan thermocouple (constantan: 60% copper, 40% nickel) is more resistant, and gives consistent performance up to 950°C.

For high temperatures the platinum-platinum rhodium thermocouple is employed. It can be immersed continuously up to 1,400°C. and intermittently up to 1,600°C., porcelain, sillimanite, or fused silica sheaths being used to prevent contamination.

It is necessary to recognise that extra thermocouple life can be secured by adequate sheathing, where the resulting slower response can be tolerated. This is so with the majority of industrial applications, but there are certain exceptions where more rapid temperature fluctuations occur which must be recorded or detected.

Thermocouples have considerable advantage over alternative measuring elements in the many different ways that they can be constructed. There are many varieties of thermocouples which are outside the normal interests of gas engineers. However, mention should be made of the rapidly widening use of the washer thermocouple on gas-fired infra-red radiant heating panels and tunnels. This thermocouple has a washer for its hot junction, which may be screwed on to the heat emitting surface. Often a number of thermocouples are connected to the instrument through a multi-point rotary switch, so that their temperatures may be measured from one central location and a true survey of the temperature uniformity rapidly obtained.

Before considering the available types of instruments, it should be remembered that the effective electromotive force is the difference between that of the hot and cold junctions of the thermocouple circuit. Therefore, the usual practice is to extend the cold junction from the thermocouple head to the instrument by means of compensating cable which has similar temperature—e.m.f. constants to the thermocouple over the ambient temperature range in which it is used. At the instrument itself compensation is made for cold junction variations, usually automatically by means of a bimetallic spiral which resets the control springs of the galvanometer.

Importance of Clean Connections

Bearing in mind the small electrical energy changes involved the need for clean and well-made connections in the circuit cannot be stressed too highly. Since the oxidising of a metal surface is sufficient to introduce an appreciable electrical resistance and so affect accuracy, plug and socket connections should only be used if of special design. For switching purposes it is better practice to use double pole rotary switches having substantial contact areas and self-wiping action.

Pyrometers.—The heart of the pyrometer measuring system is the galvanometer, which consists of a moving coil mounted between the poles of a permanent magnet. The magnetic field produced by the current flowing through the coil reacts with the field of the permanent magnet to produce a torque (as in an electric motor) which is counter-balanced by spiral control springs.

For industrial use robustness is important, and the control springs should be as strong as possible. At the same time, in order to reduce to a minimum possible errors from resistance variations of thermocouple and compensating cable, the pyrometer should have a high internal resistance. Additionally the major portion of this internal resistance should be in the form of a ballast in series with the copper moving coil, and which is usually wound in manganin, having practically no resistance variation with temperature changes.

An indicating pointer is attached to the moving coil of the galvanometer and is deflected across a calibrated scale with increase of thermocouple temperature. Although older forms were of circular shape having segmental scales, the galvanometers were pivoted horizontally and were of extremely low internal resistance. Modern forms have edgewise scales of varying lengths according to the degree of visibility required. These indicators can be arranged either for wall surface mounting, flush panel mounting, or for portable use.

Recording Pyrometers. There are a large number of industrial applications where the operator can be aided considerably in the regulation of his plant if he has a continuous record of process temperature. The chart record will yield the trend and rate of temperature change and will guide him in determining the amount of correction in the heat input necessary to maintain desired results. With heat treatment, for example, the chart record can also be of assistance to the

management should trouble develop with components in use, as their treatment can be traced and steps taken to prevent future recurrence.

It will be appreciated that, in view of the extremely low power generated, a galvanometer does not possess sufficient force to actuate a recording pen. The usual practice is to use an auxiliary source of power to operate a chopper bar, or depressor, which rapidly depresses the pointer on to an inked thread and the recording chart, releasing the pointer so that it is again free to follow temperature change. The period of time between successive depressions is generally 30 sec. which is satisfactory for the majority of industrial applications.

Where several thermocouple temperatures are required to be recorded on the same chart, the thread recorder is fitted with an automatic changeover mechanism which switches thermocouple circuits and, at the same time, brings a different colour thread into operation.

For expensive plant, and where greater legibility is required, more complicated recorders of the potentiometric type may be used. These recorders have wide charts and the recording pen is actuated by a reversible electric motor, the balancing mechanism being mechanical, electrical, or, for extremely fast operation, electronic.

Controlling Pyrometers.—For control purposes a similar arrangement of motor operated chopper bar is the most widely used system. The control switch is mounted on a control setting arm which can be adjusted to coincide with the desired temperature. In a simple on-off, or two-position, control system operation of the chopper bar will produce correct positioning of the control switch, according to the scale reading of the galvanometer pointer in relation to the control setting arm. Controllers may be either indicating or recording and there are more complicated control systems, such as multi-position or proportional-position control systems which may be incorporated.

The subject of automatic control, even if restricted to pyrometric practice, is an immense subject and could not be dealt with adequately in a short paper such as this.

There should be mentioned, however, two important plant characteristics which seriously influence the results obtained from controllers, and a consideration of them will guide the selection of suitable equipment.

The most important plant characteristic is that of process lag, this being the interval of time between the alteration of heat input and the resulting temperature change.

Of next importance is the demand changes—*i.e.*, the variation in the heat demand by the charge or process, the extent of the variations, and the rapidity with which these changes occur. If the process lag is short, as in ovens having forced air circulation for example, close control can usually be obtained with the simple two-position controller, even when wide demand changes occur. Should moderate or long process lag be present, the simple control systems should be selected only if the demand changes are small or take place slowly. Certainly, the combination of long process lags and rapidly changing demands of varying magnitude presents considerable difficulty and complicated control systems offer the only satisfactory means of solution.

TRADE NEWS

New World 75 Cooker

THE New World 75 cooker, introduced by Radiation Ltd., is of attractive modern appearance. The open and the hotplate/grill units are designed independently and are separated by a clear space. The oven flue gases are vented forward beneath the plategrid to avoid staining the wall and to make some use of the heat in the flue gases for warming plates. The cooker may be fitted flush to the wall if desired. All taps are of the safety type, mounted on the front of the cooker where they are easily seen and operated; the oven tap is easily identified as it is placed apart from the hotplate taps. A built-in constant pressure governor ensures steady performance.

The overall dimensions of the cooker are:—

Height, 36 in. to hotplate level, 55½ in. to splashplate top.

Width, with gas match, 24 in.

Depth (including door knob), 21½ in.

The hotplate itself is 22 in wide × 18 in. deep, while the oven casing, excluding the Regulo knob and door handle, measures 29 in. to crown tray, 21¼ in. wide, and 19¼ in. deep. The door opening is 18 in. wide × 16 in. high and the oven depth is 14 in. from front to back.

The cantilever principle of general design allows the hotplate to be wider than the oven, so giving wide spacing of the boiling burners. There are four boiling burners and a covered centre-burner grill. The ratings are:—

	B.Th.U. per hour
Front left ring burner	11,000/12,000
Rear left Rado burner	7,000/ 8,000
Rear right Rado burner	9,000/10,000
Front right Rado burner	7,000/ 8,000
Grill burner	13,000/14,000

The open space between hotplate and oven gives easy access for wiping the crown tray, which is shaped to guide the grill pan and has ample capacity for spillage. The crown tray is located at the back and is easily removable.

The wide New World oven is of ample capacity and has rounded corners for easy cleaning. The oven grids have nickel-chrome finish for durability and easy cleaning. The oven has Regulo control, a single back burner (rating 11,000/12,000 B.Th.U. per hour) and a spring-sealed oven door which helps to conserve heat and to ensure the highest standard of cooking quality. The cast iron oven front is vitreous-enamelled for easy cleaning. The oven door covers the full width of the front of the cooker and the hinges are hidden when the door is closed. Good insulation and the use of separate outer panels ensure that the outside surfaces of the oven unit do not become overheated.

The structure of the cooker is of composite form, based on the cast front frame of the oven unit, the latter being enclosed by separate vitreous-enamelled outer panels—the fixed crown side panels, full width door panel, and fixed masks above and below the door. The oven is insulated by fibreglass and aluminium foil, a combination having low heat capacity and high insulating quality.

The cooker is completed by a vitreous enamelled splashback and upward-folding plategrid; the latter is easily lifted out for cleaning. A rectangular duct with a rear polished aluminium protection screen is incorporated behind leading to a rectangular outlet grille in the centre of the splashback for forward venting of the oven gases. The grille is clipped in position and can be readily removed for cleaning purposes. Radiation stain-resisting vitreous enamels are used throughout.—*Radiation Ltd., Radiation House, Stratford Place, London, W.1.*

(*Further Trade News on Next Page*)